DOCUMENT RESUME

ED 334 364 CE 058 372

TITLE	The Minnesota Plan for Industrial Technology Education. A Planning Guide.
INSTITUTION	Minnesota State Dept. of Education, St. Paul.
PUB DATE	91
NOTE	21p.
AVAILABLE FROM	Minnesota Curriculum Services Center, 70 West County Road B2, Little Canada, MN 55117.
PUB TYPE	Guides - Classroom Use - Teaching Guides (For Teacher) (052)
EDRS PRICE	MF01/PC01 Plus Postage.
DESCRIPTORS	Communications; Curriculum Development; Elementary Secondary Education; Energy; Experiential Learning; *Industry; Manufacturing; Power Technology; Production Techniques; Teaching Guides; *Technology; *Trade and Industrial Education; Transportation
IDENTIFIERS	Minnesota; *Technology Education

ABSTRACT

The Minnesota plan for industrial technology education provides educators with a coordinated plan for kindergarten through grade 12. Part 1 explains the mission and goals of industrial technology education. It describes the philosophical basis for including the subject matter in school curriculum, the levels of learning, and the reasons supporting them. It also defines a structure of curriculum that responds to educational legislation. Program levels have different program emphases: (1) elementary students develop an awareness of technology; (2) junior high students explore industrial technology; and (3) senior high students become oriented and prepare for a life in a technological society. In part 2, a planning guide enables teachers and administrators to: (1) identify curriculum development procedures strategies; (2) identify teaching strategies; and (3) locate resources and educational aids to supplement curriculum materials. The guide provides a foundation for ideas, suggestions, alternatives, and recommendations. Programs are outlined at all educational levels in communication, energy and power, production, and transportation. (NLA)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

INDUSTRIAL
TCNLG
EDUCATION

THE MINNESOTA PLAN FOR INDUSTRIAL TECHNOLOGY EDUCATION

A PLANNING GUIDE

ED334364

CE058372

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

☐ This document has been reproduced as received from the person or organization originating it.

☐ Minor changes have been made to improve reproduction quality.

• Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

C Hanson

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

BEST COPY AVAILABLE

MISSION STATEMENT FOR MINNESOTA EDUCATION

As adopted by the Legislative Commission on Public Education

The purpose of public education is to help individuals acquire knowledge, skills, and positive attitudes toward self and others that will enable them to solve problems, think creatively, continue learning, and develop maximum potential for leading productive, fulfilling lives in a complex and changing society.

TABLE OF CONTENTS

INTRODUCTION 1

PART I — MISSION AND GOALS

RATIONALE
THE MINNESOTA PLAN FOR INDUSTRIAL TECHNOLOGY EDUCATION 3
MISSION STATEMENT FOR INDUSTRIAL TECHOLOGY EDUCATION 3
GOAL STATEMENTS 3
CURRICULUM MODEL 4
LEARNING IMPACT OF THE MINNESOTA PLAN 6

PART II — PLANNING AND IMPLEMENTATION 8

WHY CHANGE INDUSTRIAL TECHNOLOGY EDUCATION 8
TECHNICAL AREAS IN INDUSTRIAL TECHNOLOGY EDUCATION 8
CONTENT ORGANIZERS 8
PROGRAM EMPHASIS 9
- Awareness (Elementary)
- Exploration (Junior High, Middle School)
- Orientation (Beginning High School)
- Preparation (High School)

USING A SYSTEMS APPROACH TO RELATE INDUSTRIAL TECHNOLOGIES TO SOCIETY 12
- Introduction
- Defining a System
- What This Means to a Teacher

IMPLEMENTATION PROCESS 12
- Leadership
- The Cycle
- Leadership Team
- Instruction Team
- Community Relations

HOW SHOULD YOU TEACH? 15

RESOURCES 16

INTRODUCTION

The ***Minnesota Plan for Industrial Technology Education*** has been developed to provide educators with a coordinated plan for kindergarten through grade twelve. The plan has three parts.

PART ONE of this document explains the mission and goals of industrial technology education. It identifies the uniqueness of the subject matter — industrial technology — and describes the philosophical basis for including this subject matter in the school curriculum. It describes the levels of learning, the unique ability of the student to achieve higher level thinking skills and to apply the basics in "real-life" situations, and the reasons supporting the essential nature of these learnings. Part one also defines a structure of curriculum that responds to the following legislation:

> *The commissioner of education shall develop a curriculum for the industrial technology program that incorporates the instructional competencies found in secondary industrial arts and secondary vocational trade and industrial occupations programs.*

PART TWO of this document is a planning guide which can be useful to teachers and administrators as they work to meet the needs of their students and plan within their facility and resource constraints. It will help to:

- identify curriculum development procedure strategies
- identify teaching strategies
- locate resources and educational aids to supplement curriculum materials.

Users of this planning guide should keep in mind that the guide covers a broad range of situations. It can provide a valuable foundation for ideas, suggestions, alternatives, and recommendations. It can also be used to insure the continuation of valid programs to prepare students for a changing future. Teachers are encouraged to use the ideas presented to improve their programs by developing the best curriculum possible to meet the needs of today's students in a technological society.

PART THREE of the Minnesota Plan (not part of this document) consists of *Communication, Energy & Power Utilization, Production and Transportation* curriculum guides. These guides, which offer specific plans for instruction in the four curriculum areas in industrial technology, are available from the Minnesota Curriculum Services Center, 3554 White Bear Avenue, White Bear Lake, MN 55110. 612/770-3943.

PART I—MISSION AND GOALS

RATIONALE

Technology—Changing Every Day

Discoveries are being made worldwide every day. Innovations in communication, medicine, transportation, robotics, energy and aerospace technology are only a few of the fields under constant exploration and transition. This is accomplished by a society that yearns to discover and strives to excel, as evidenced by the fast pace at which new innovations reach the marketplace or become the subject of mass media feature stories.

Technology Increases Standard of Living

Most people will agree that the standard of living has *increased* dramatically. People do things differently today than they did 100, 50, 25, or even 5 years ago. Technology is one of the causes of these changes.

Energy and Power Utilization systems encompass more than the traditional fossil fuels. Production systems have clearly gone beyond the human operated mass production line as computer-aided manufacturing (CAM) and robotics change the nature of the workplace. The space shuttle has become a major breakthrough in transportation technology and communication systems continue to increase in speed and versatility.

Technology/Industry/Technological Literacy

Industrial Technology is a comprehensive educational program concerned with technology, its evolution, utilization, and significance; with industry, its organization, personnel, systems, techniques, resources, and products; and the social/cultural impact of both technology and industry.

Technology—*the knowledge and study of human endeavors in creating and using tools, techniques, resources, and systems to manage the man-made and natural environments for the purpose of extending human potential and the relationship of these to individuals, society, and the civilization process.*

Industry—*that section of the societal economic institution that uses resources to produce goods, services, and information to meet the needs and wants of individuals and society.*

Technological Literacy—*being able to understand the relationships between technology today and social change. A person who is technologically literate understands how the systems of technology interrelate with one's social/cultural lifestyle. Technological literacy enables the person to better make decisions about the future. It is not sufficient to be literate only within specific technologies, but also to be literate in how these specific technologies change and impact upon our lives. Industrial Technology Education provides a curriculum whereby students can become technologically literate.*

BEST COPY AVAILABLE

Effectiveness of Industrial Technology Programs

As we look at how technology has caused changes and think about the possibilities in store for the future, it becomes necessary to ask ourselves an important question. As educators, administrators, or parents, do we believe that our present programs are meeting students' needs by preparing individuals who can cope with, live, and work in an industrial technological society?

As we evaluate our industrial technology education program, it becomes increasingly apparent that we need to continually review and update programs in light of technological change.

In keeping with the characteristics of American society, it has become necessary for the education system to discover and excel. Today's teachers need to be teaching students about today and preparing them for tomorrow.

THE MINNESOTA PLAN FOR TECHNOLOGY EDUCATION

The Minnesota Plan for Industrial Technology Education provides direction to educators as they plan, manage, and evaluate their curricula to help students become technologically literate, equipped with the necessary skills to cope with, live, and work in an industrial-technical society.

An updated industrial technology program can help a student improve mental, physical, and social capabilities. Mentally, individuals can solve problems to understand and deal with technological changes. Physically, students will be able to manipulate materials. Socially, students will improve capabilities in relating to individuals and interacting with people as they cooperate with others to find solutions and make decisions.

The Minnesota Plan is a new tool for educators. It is a guide that teachers and administrators can employ as a reference while they take a look at their industrial education program to determine utility and effectiveness. Just as other more familiar tools are used to shape, form, finish and manipulate products, the Minnesota Plan is an instrument to help industrial educators plan, manage and evaluate programs.

It is clear, then, that the objective of the Minnesota Plan is to provide direction for educators. In order to meet this objective, a mission statement and eight goals have been developed.

MISSION STATEMENT FOR INDUSTRIAL TECHNOLOGY EDUCATION

The study of industry and technology should result in people who participate in and adapt to a dynamic technological society. They provide application and immediate relevance to principles of math, science, and other subject areas. They focus on the development and application of industrial technologies and develop students who are self-learners and problem solvers, as well as self-reliant and productive members of society.

GOAL STATEMENTS

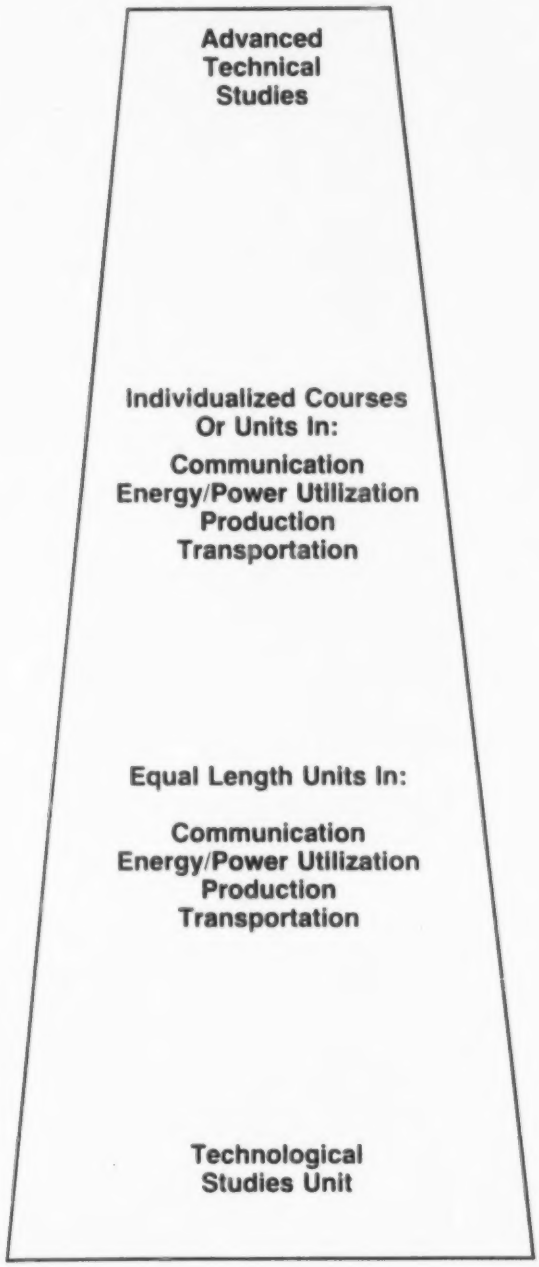
Consistent with the student's abilities, interests, and needs, industrial technology education must:

1. Prepare students to work with technical systems within the areas of communication, production, transportation and energy/power utilitization.
2. Assist students in assessing and preparing for current and emerging occupations.
3. Enhance student mastery of the basics through application of math, science, social studies, communication, and computer literacy.
4. Develop student awareness and skill through the safe utilization of tools, materials, and equipment.
5. Provide students with a foundation in entrepreneurship, economics, and business relationships.
6. Assist students in becoming independent learners and creative problem solvers who possess self-confidence and lifelong learning attitudes.
7. Establish beliefs and values based upon the impact of industry and technology and how it alters environments.
8. Explore and develop human potential related to responsible roles in a technological society.

THE MINNESOTA PLAN FOR INDUSTRIAL TECHNOLOGY EDUCATION

PROGRAM LEVEL

PROGRAM EMPHASIS



Senior High School

PREPARING for life in a Technological Society

Becoming ORIENTED to Industrial Technology

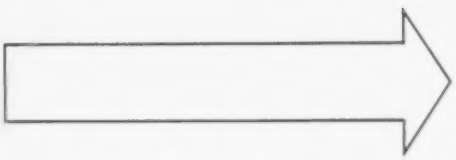
Junior High or Middle School

EXPLORING Industrial Technology

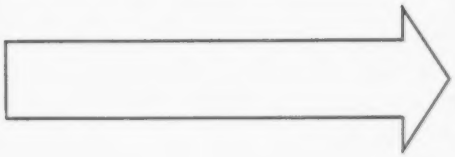
Elementary School

Becoming AWARE of Technology

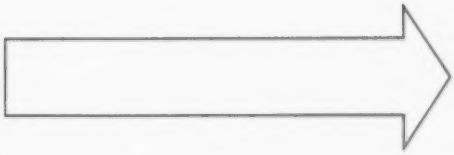
CURRICULUM MODEL



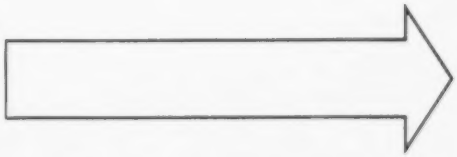
At the senior high level, students will ultimately decide if the skills acquired are to be used for job-entry or as a basis for advanced technological, scientific, or professional study. The program supplies the student with a basis for education and career planning, while providing motivation to learn and enrichment in basic skills through practical applications.



At the senior high level, semester courses have been developed which orient the students to each of four major industrial technologies: communication, energy and power utilization, production, and transportation. These four courses may comprise the entire high school offering, or they may provide an intermediate offering between the junior high/middle school and the upper senior high.



At the junior high/middle school level, students are required to participate in an industrial technology experience. This unique opportunity provides all student with a highly motivating, activity-based overview of industrial technology, including technological resources, processes, applications and their impacts on society and the environment. To accomplish these goals, 4 and ½ week units in communication, energy and power utilization, production and transportation have been developed.



At the elementary level, industrial technology content can provide enrichment to many present offerings. The primary objective is to help children develop an awareness of technology. Technology content and high interest activities can be integrated into many areas of the elementary curriculum. Resources for teaching elementary-level industrial technology are included in the bibliography of this document.

LEARNING IMPACT OF THE MINNESOTA PLAN

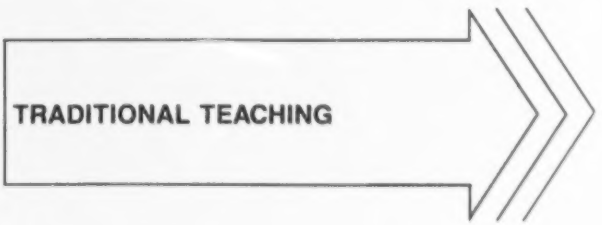
This chart presents a strong rationale for "involvement learning". Subjects such as Industrial Technology Education are an essential part of every school's curricula. Not only do students learn about technology, careers, and life skills, but they are provided an opportunity to use higher order thinking skills. Industrial Technology Education teachers, working with students in a well-equipped laboratory, bring all the pieces of education together in a meaningful, real-life manner.

The levels represent how students usually learn, from simple to complex skills. Helpful verbs describe the learning levels.

LOWER ORDER SKILLS

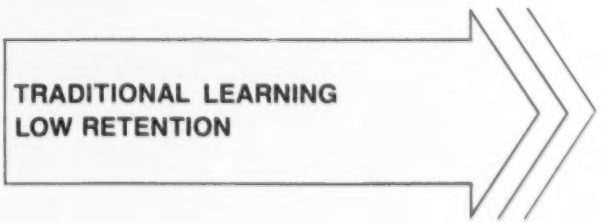
1. Knowledge	2. Comprehension	3. Application
match	translate	relate
name	reword	exercise
arrange	qualify	try
spell	expand	solve
label	restate	handle
select	alter	operate
		manipulate

TEACHING LEVELS
Traditional classroom teaching tends to concentrate on the lower order skills of knowledge and comprehension.
The Minnesota Plan for Industrial Technology Education emphasizes not only the lower order skills, but challenges students with activities requiring higher order thinking skills such as application, analysis and synthesis.



THE MINNESOTA PLAN FOR INDUSTRIAL TECHNOLOGY EDUCATION

LEARNING LEVELS
Retention is related to learning level. RESEARCH suggests that when students learn at the first two levels, they retain only 20 percent of the material after six weeks.
"Involvement learning"—with its emphasis on higher order skills—results in far higher retention rates.



"INVOLVEMENT LEARNING"—HIGHER RETENTION

A program which is hands-on and experiential in nature requires the application of all basics, such as mathematics, physical science and communications. As you review helpful verbs for each of the higher order skills, it becomes clear that an industrial technology education lab is the ideal setting to teach higher order thinking skills and problem solving. In addition, the application of math, science and language arts enhances the students understanding and retention of these basics and helps them understand why their mastery is important. It is much easier to teach and learn when the need for teaching and learning is understood and students are motivated.

HIGHER ORDER SKILLS—"INVOLVEMENT LEARNING"

4. Analysis

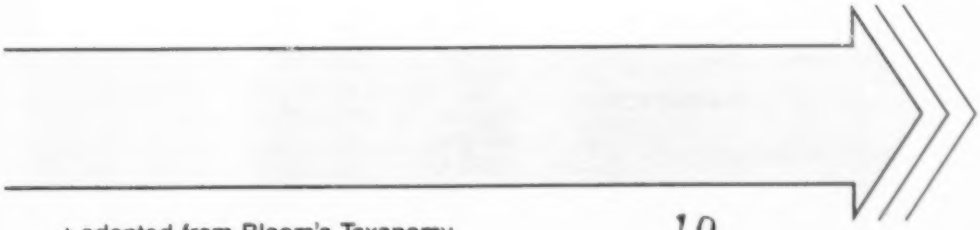
examine
inspect
divide
search
reason
deduce
canvass

5. Synthesis

create
build
breed
compile
develop
produce
compose

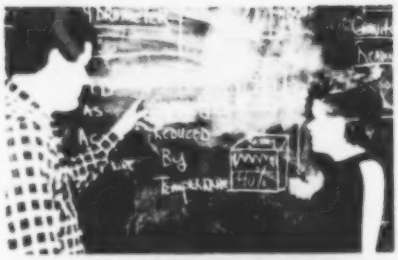
6. Evaluation ★

judge
appraise
accept
criticize
reject
classify



★ adopted from Bloom's Taxonomy

PART II - PLANNING AND IMPLEMENTATION



WHY CHANGE TO INDUSTRIAL TECHNOLOGY EDUCATION

We've been through times when names like manual training, manual arts, and industrial arts were descriptive of our field. In those other times, both working and learning about work were organized by relatively independent crafts or trades. Occupations like blacksmithing or carpentry tended to be concerned with a single material such as wood or metal and, of course, school facilities took on a similar pattern.

So why change? When one considers the totality of modern industrial/technical activities in our world, the role of the crafts or tradesperson is different than it once was. Spending large portions of our time teaching about a single material or craft is very hard to justify today.

So where does one begin? Given unlimited time and energy, one could begin almost anywhere in the study of technology. But, given the constraints of time, money and personal energy we all share, we must select some aspect of technology to study.

Medical technology, agricultural technology and many other fields of specialty may be important, but realistically, we must restrict ourselves to industrial technology or even selected industrial technology. By doing so, we can better prepare as instructors, and provide more realistic experiences for students, so that they might learn by experience rather than only through ill understood and soon forgotten abstraction.

TECHNICAL AREAS IN INDUSTRIAL TECHNOLOGY EDUCATION

Industrial Technology is still a very broad concept, encompassing a significant part of all human endeavor. Industrial Technology can be viewed from many different perspectives and divided or subdivided in many ways. It needs to be divided and grouped into elements which are generally reflective of human endeavor and provide a logical structure. Many subdivisions have been suggested and used; no one is right or wrong.

When considering that these elements are content organizers—methods of grouping similar understandings or learnings—the number and specifics become less important than other concerns like: 1) have all important concepts been included? and 2) will this organization assist or facilitate student learning about industrial technology?

CONTENT ORAGANIZERS

The content organizers recommended in this planning guide are: 1) communication, 2) energy and power utilization, 3) production, and 4) transportation. The rationale for their inclusion is simple: people, in their use of technology to control their surroundings and improve their world through technical means, engage in all of these activities; they communicate, they utilize energy and power, they produce and they transport.

Educators need **not** assume that the breadth of the four content organizers (communication, energy and power utilization, production and transportation) and the increased emphasis on understanding **why** as well as **how** means that learning about industrial technology must become just another lecture course. This document and the four supporting documents are all designed around the premise that the majority of student

BEST COPY AVAILABLE

learning should be through- "involvement learning." This- involvement learning will probably result in many small projects and may take the form of experimentation, problem solving with industrial equipment or materials, exercises, testing and design.

PROGRAM EMPHASIS

Awareness (Elementary)

Industrial Technology Education can enhance all forms of learning at the elementary level. The areas of fine arts, language arts, mathematics, science and social studies form the core learning areas. Industrial Technology Education activities can be infused into traditional teaching and learning to provide various advantages. These include motivation, understanding, appreciation, establishing relationships, providing problem solving experiences, enhancing higher order thinking skills, and providing an application of mathematics, science and many other concepts.

Communication activities, such as printing or publishing through conventional or electronic means, are adaptable to a variety of elementary areas. Production of models, toys, and tools can add tangibility to many subjects. Energy concerns and related areas such as conservation can relate to a variety of subjects and concepts. Transportation activities such as building and testing model cars, airplanes or rockets can add realism to the core learning.

In fact, the study of technology may be one of the most underutilized areas in elementary education. The sheer joy of producing something useable, and the enhancement of motivation and self-esteem which occurs, are in themselves sufficient inducements to include industrial technology activities.

Exploration (Middle School/Junior High School)

In Minnesota, Industrial Technology Education is a required part of a student's program of study. The hour requirement varies by the grade arrangement of the junior high or middle school. Commonly, students take nine weeks of industrial technology at each of grades seven and eight, or a semester at one of those grade levels. Recognizing this common time allocation, four and one-half week units have been developed in communication, energy and power utilization, production and transportation. It is recommended that equal length units in these four areas be offered.

The emphasis at this level is on exploration using involvement learning, a teaching/learning environment in which students will complete numerous small projects and participate in a variety of other activities.

Instruction at this level should provide broad exposure to fundamental concepts of industrial technology. The program should include opportunities for student planning, experimenting, and work in a variety of activities related to technology. Opportunities to study underlying functions of industrial technology and to explore inherent interrelationships should be a part of the total program. As a result of this experience, students should begin to assess their interests and aptitudes and be able to perceive the effect of industry and technology on their environment.

Educators who developed the Minnesota Plan for Industrial Technology Education worked to achieve balance of appropriate content while considering the needs of learners. Teachers with expertise and experience in communication, energy and power utilization, production and transportation have developed exploratory units. Each unit contains learner outcomes, suggested activities and references which will assist the teacher wishing to implement this material.

The four and one-half week units and an outline of the material contained in each follows:

Communication
- Overview of Communication Technology
- Design/Drafting
- Photography
- Graphic Arts
- Broadcasting
- Telecommunication

Transportation
- Introduction to Transportation Technology
- Materials Handling Conveyors
- Terrestrial Transportation
- Marine Transportation
- Atmospheric Transportation
- Space Transportation

Energy & Power Utilization
- Energy Sources
- Measurement of Energy & Power
- Control of Energy & Power

Production
- Introduction to Production Technology
- Managing the Enterprise
- Materials Processing
- Research and Development
- Producing
- Marketing
- Servicing

Orientation (Beginning High School Level)

Orientation is the level above the junior high/middle school experience as a student moves through the program. It fulfills the need for a longer course for that student who wishes to further pursue an interest identified during exploration, or can provide an initial experience for the student who may have missed that opportunity at a lower grade level. The emphasis is still on the use of involvement learning to provide breadth of experience, overall knowledge, and the understanding of interrelationships within industrial technology.

For the orientation level, four semester-length units have been developed in communication, energy and power utilization, production and transportation. These units contain suggested learner outcomes, activities, and references. They, in conjunction with fold-out charts entitled **Elements of Communication, Elements of Energy and Power Utilization, Elements of Production, and Elements of Transportation** accompanying each unit, should allow an instructor to plan a course offering a balance of content in resources, technical processes, industrial application and technological impact.

For small schools or single-person departments, these four one-semester courses may comprise the entire senior high school offering. The breadth of knowledge about industrial technology offered by such a program would provide excellent preparation for nearly any trade, technical or professional occupation a student may wish to enter.

A content outline from each of the four one-semester courses follows:

Communication

Introduction to Communication Technology
Design/Drafting
Photography
Graphic Arts
Broadcasting
Telecommunications

Transportation

Introduction to Transportation Technology
Materials Handling Conveyors
Terrestrial Transportation
Marine Transportation
Atmospheric Transportation
Space Transportation

Energy and Power Utilization

Introduction to Energy & Power Utilization
Fossil Fuels
Wind and Water Resources
Solar Resources
Energy Conservation
Nuclear Energy
Measurement of Energy & Power
Control/Conversion of Energy & Power

Production

Introduction to Production Technology
Managing the Enterprise
Materials Processing
Research and Development
Producing
Marketing
Servicing

BEST COPY AVAILABLE

Preparation (Advanced Technical Studies)

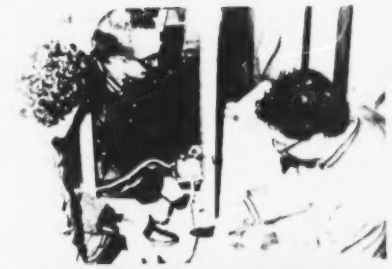
Curriculum at this level must be diverse enough to meet a broad range of student needs. The preparation level prepares students both for advanced education and entry into the job market. The Minnesota Plan for Industrial Technology Education enhances the relationship between vocational and industrial arts education. Whether anticipating further education or job entry, the preparation level of the Minnesota Plan provides the necessary instruction. If the Minnesota Plan is implemented with rigor and the goals of the plan achieved, student needs will be met whichever direction is chosen.

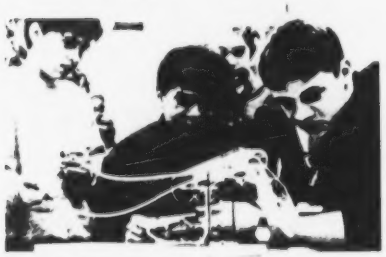
A chart showing some suggested advanced technical courses at the preparation level follows. Each of these courses is designed to represent new and emerging technologies, program innovation, and support for other educational fields. Courses appear under more than one content organizer to reflect program emphasis.

A student may elect an industrial technology course for a variety of reasons including job entry, pre-tecnical or pre-professional. Regardless of students' objectives, the ability to apply math and science concepts in real-life situations, the ability to use a computer to perform an industrial design function, or the ability to apply technology in solving a variety of problems can be enhancement to their education. Following are some examples of how courses might be combined to fulfill varying student needs and objectives.

Junior/Middle 4½ Week Units	Beginning High School Semester Units	
Communication	Communication	Broadcast/Media Communication/Media Electronics Drafting Industrial Design Technology
Energy & Power	Energy & Power	Control Technology Electronics Electro-Mechanical Technology Mechanical Technology Principles of Technology Vehicle Services
Production	Production	Construction Drafting Electro-Mechanical Technology Mechanical Technology Metal/Materials
Transportation	Transportation	Auto Body Repair Aviation Vehicle Services

Job Entry	Pre-Technical	Pre-Professional
(Machine Operator)	(Electronics Technician)	(Engineering)
Drafting	Electronics	Principles of Technology
Metal/Material Processing	EMT	Electronics
Independent Study or Coop.	Control Technology	Control Technology
	Broadcast/Media	Design Technology
	Independent Study or Coop.	





USING A SYSTEMS APPROACH TO RELATE INDUSTRIAL TECHNOLOGIES TO SOCIETY

Introduction

Within each of the four content organizers in the Minnesota Plan, emphasis is placed on the use of a system to develop technological literacy. Resources, technical processes, industrial applications and the impact of technology are all essential components of this technological system.

Defining A System

A system is a body of content that shows the interrelationships between different areas. Figure A shows an example of a technological system. Resources are inputs to each of the technical areas. Technical processes provide ways to manipulate resources. Industrial applications are the outputs of the technical areas. Technological impact considers the results of using technology. By using the systems approach, a strong emphasis can be developed that shows the relationship between the technologies and society.

Page 14 of each of the four *Communication, et al.* curriculum guides is a fold-out chart providing a wealth of material to supplement teaching about resources, technical processes, industrial applications and technological impacts.

Even broad areas such as communication, energy and power utilization, production and transportation do not work independently. A systems approach can be used to understand how each of these areas relates to the other three. Production technology, for example, involves aspects of communication, energy and power utilization, and transportation. Figure B shows how the Industrial Technology Education system is utilized within each of the four interrelated content organizers.

Selecting and balancing educational materials which examine resources, technical processes, industrial applications, and technological impact assures that students will be introduced to the full scope of industrial technology. Interrelating this material to each of the content organizers allows a broad perspective to be developed. With this approach the student not only learns technical information but also develops technological literacy.

What This Means to a Teacher

For the teacher, two points stand out from use of a systems approach in the teaching of industrial technology. First, all topics considered can be related to the whole curriculum by specifying their place in the technological system as resources, technical processes, industrial applications, or technological impact. In this way, the meaning of each piece of the curriculum is enhanced by becoming part of the whole picture.
The second consideration in using a systems approach to teach industrial technology is that all content areas are interrelated. Even when examining one of the four curriculum areas, relating the material to the other three content organizers supports the teaching of the whole of industrial technology, not just one of its parts.

IMPLEMENTATION PROCESS

Leadership

There is a direct relationship between the quality of a program and the level of district/community support. The leadership required to obtain this support may come from top down, bottom up, or from the community. It is important that leadership emerges from, and involves all appropriate audiences.

Program Development Cycle

Frequently, the process essential for bringing about change can be

BEST COPY AVAILABLE

as significant as the change itself. The process brings about professionalism on the part of the staff, commitment on the part of administration, and support on the part of the community.

The Program Development Cycle is intended to provide a systematic review of curriculum (what is being taught). The rationale for the cycle is that programs need to be constantly reviewed because of changes in materials, technological change, equipment, state laws, community attitudes and local assessments. The Program Development Cycle gives the educators and the community an opportunity to determine how well their programs are fulfilling their original expectations. This process is ongoing, with cycles completed every four to seven years.

The Program Development Cycle provides the framework for answering simple program questions. Why do the programs exist? What are the students expected to learn? How well are the programs meeting expectations? What can be done to improve upon weaknesses? What staff development and equipment needs have to be addressed?

The Cycle

Phase 1. Why does the program exist and what are students expected to learn? Develop statement of program intent. Identify needed data base.

Phase 2. How well is the program meeting the intent? Assess the program. Analyze evidence. Identify strengths, weaknesses, and concerns.

Phase 3. Does an outside audit team agree with the staff assessment? Develop improvement plan.

Phase 4. Implement Improvement Plan. Monitor improvement plan. Engage in appropriate staff development activities, purchase necessary equipment and make facility changes as required.

Phase 5. Review and monitor program operation. Prepare to re-cycle.

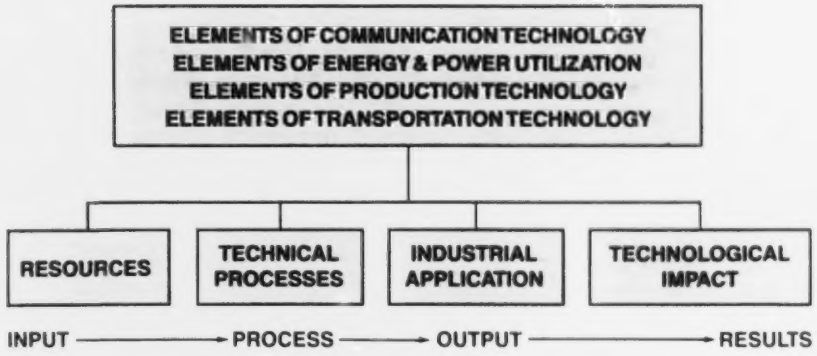


FIGURE A

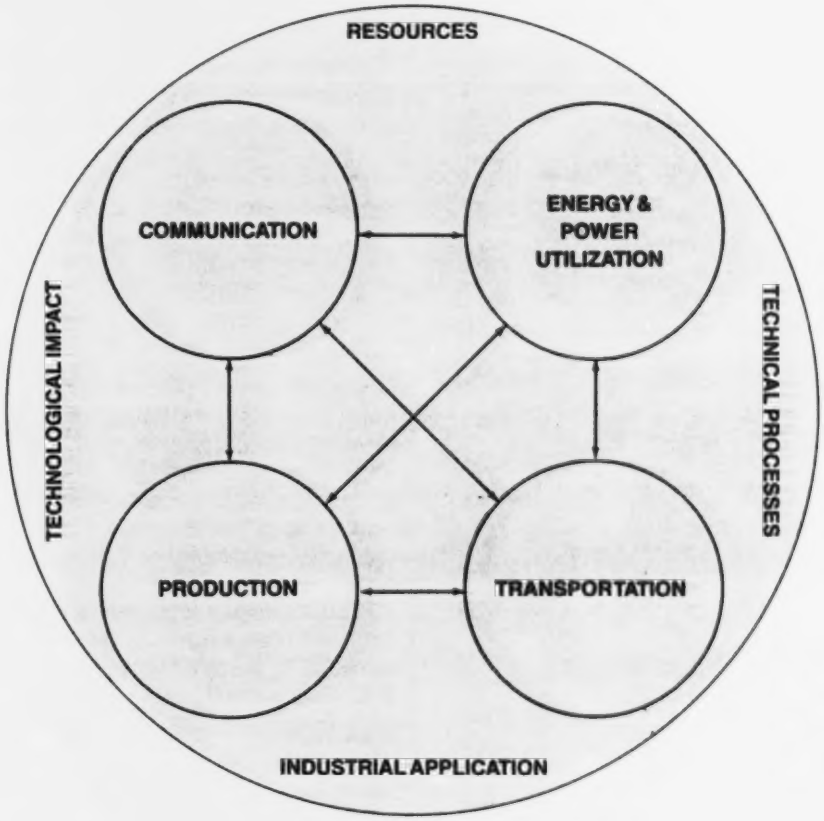
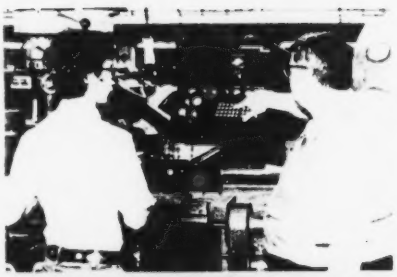
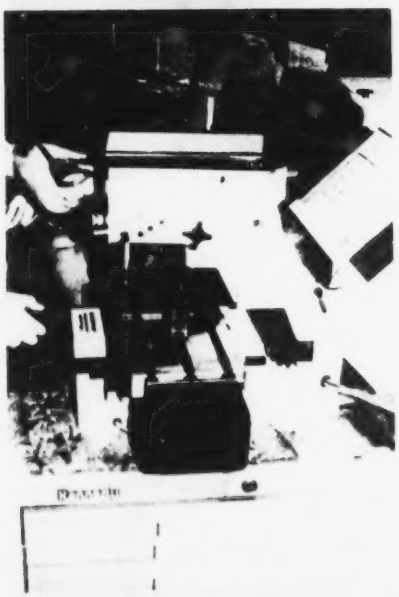


FIGURE B





Leadership Team

To implement the program development cycle, leadership and instruction teams should be established. The leadership team is responsible for the administration of the program and development cycle. Recommended membership of the team is as follows:

1. Members of the industrial technology staff
2. Principal and one other administrator
3. Curriculum director
4. Counselor
5. Parent
6. Four members of industry (representing the four areas of communication, energy and power utilization, production, and transportation.)

The leadership team should assess the current status of industrial technology/arts and vocational trade and industrial programs and decide if a commitment to the Minnesota Plan will be made. A resource assistant from the State Department of Education (612/296-3306) should be contacted to assist with the development process.

Once the leadership team has made a commitment to implement the Minnesota Plan, it should organize an instruction team to develop specific operational recommendations. The leadership team should then reconvene to consider all instruction team recommendations and develop an implementation plan to be adopted by the school board.

Instruction Team

The instruction team must give particular attention to the goal statements of the Minnesota Plan. These goal statements (page 3) are the key to success and what makes industrial technology an integral and essential part of education. These goal statements are considered to be minimal to meet basic program requirements.

Using the Minnesota Plan curriculum guides, the instruction team should then address these questions: (1) How can the units be taught to best achieve the targeted goals? (2) How can this be done within the limitations of the facility? and (3) What equipment and materials are essential--what do we have and what do we need? Recommendations for the leadership team showing how the Minnesota Plan could be implemented should include:

1. K-12 curriculum plan
2. Facility needs
3. Equipment and supply needs
4. Staffing recommendations
5. Staff in-service needs
6. Scheduling suggestions
7. Implementation timetable
8. Internal and external assessment plan.

The Minnesota Plan recommends that all units of instruction consist of classroom instruction reinforced by laboratory activities to provide motivation and higher order learning. Projects and "hands-on" activities should support program goals and are strongly recommended.

Community Relations

The Minnesota Plan provides positive steps for developing technological literacy. It is recommended that, when implemented, staff make presentations to the parent organizations and community service clubs, *e.g.* Rotary, Kiwanis, Optimists, or Chamber of Commerce. It is also suggested that articles be written for the local newspapers on a regular basis which highlight some of the instructional activities that demonstrate how Industrial Technology Education programs assist in the development of our youth.

BEST COPY AVAILABLE

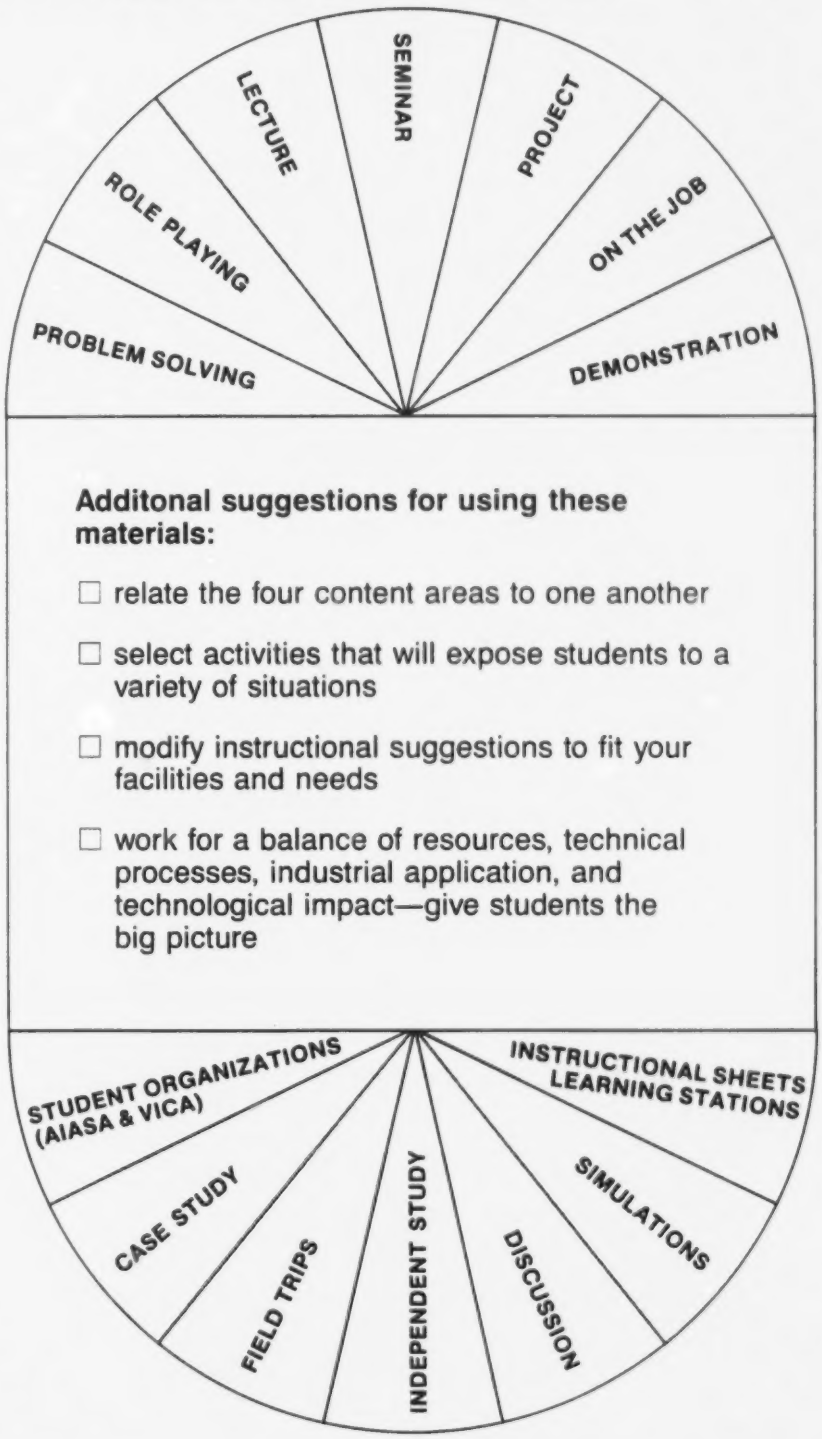
HOW SHOULD YOU TEACH? METHODOLOGIES CAN BE EXPANDED

Because of the great amount of new and additional technological information, the teacher can expand both methods and effectiveness.

In order to successfully implement an industrial technology education program, instructional strategies should be analyzed. Traditionally, three methods have been used to teach industrial subjects. These have included lecture, demonstration and project construction.

Choose teaching strategies that help you accomplish your goals and objectives. Be flexible! Try many different approaches throughout your lessons. Variety contributes to effectiveness. Most of the strategies shown here should be familiar to you. If not, get some help the first time through.

One underutilized approach needs to be emphasized. All *superior* Industrial Technology programs have active youth organizations. Two organizations are available. The American Industrial Arts Student Association (AIASA) is geared primarily to students at the exploration and orientation levels grades (6-10) and the Vocational Industrial Clubs of America (VICA) organization relates primarily to students at the preparation level (grades 11 & 12). Activities suggested by these organizations can and should be integrated into classroom instruction. In this way students can become proficient in learning in still another meaningful way. For assistance in beginning a youth organization, call the Industrial Technology Consultants at 612/296-3306.


SEMINAR
PROJECT
ON THE JOB
DEMONSTRATION
PROBLEM SOLVING
ROLE PLAYING
LECTURE
Additonal suggestions for using these materials:
☐ relate the four content areas to one another
☐ select activities that will expose students to a variety of situations
☐ modify instructional suggestions to fit your facilities and needs
☐ work for a balance of resources, technical processes, industrial application, and technological impact—give students the big picture
INSTRUCTIONAL SHEETS LEARNING STATIONS
SIMULATIONS
DISCUSSION
INDEPENDENT STUDY
FIELD TRIPS
CASE STUDY
STUDENT ORGANIZATIONS (AIASA & VICA)

RESOURCES

Preparing To Teach The New Content

There are many ways to become prepared to teach Industrial Technology Education. Getting updated can be done by many methods. Some suggestions:

Attending Workshops

Updating workshops are continually being held throughout the State. These workshops may cover specific topics such as computers, CADD, CNC, or some other speciality. Workshops of a more general nature will be held on an ongoing basis to assist teachers in the implementation of the Minnesota Plan.

Visiting Business/Industry

Take time to participate in activities of business and industries in your area. Consider visiting a larger city near you to get a first-hand view of the processes and operations they use.

Visiting Other Schools

You can learn from other teachers who are already doing new things. Most are happy to show you around if given some advance notice of your interest in visiting.

Contacting Universities

University faculty can provide assistance, suggestions, names of consultants, materials, and other help. In addition, in-service activities can be provided to your school system.

Working in Business/Industry

Many companies are willing to set up temporary positions for educators to enable them to obtain experience in a business or industry. Look into an opportunity like this for a few weeks during your summer. Graduate credit or wage compensation can often be arranged.

Contact The State Department Of Education

You may wish to have a specialist visit your school or you may wish to inquire about other schools to visit. Materials on a variety of subject/topics are available. Call the industrial program consultants at 612/296-3306.

Reading Books, Technical Literature And Recent Periodicals.

A wealth of information is available for your professional reading. The *Communication, Energy & Power Utilization, Production* and *Transportation* guides contain extensive resource lists.

Writing To Organizations And Companies.

The four area guides contain many suggested sources of additional information. Most are very reasonably priced or free.

Join Your Professional Organization

STATE ASSOCIATIONS:

Minnesota Industrial Techology Education Association

Contact 612/296-3306 for names of current officers and directors

Minnesota Techical And Trade & Industrial Association (MTTIA)

Contact 612/296-3306 for names of current officers and directors

Vocational Industrial Clubs Of America (VICA)

Contact 612/296-3306 for the names of current officers and directors

Minnesota Vocational Association

3554 White Bear Avenue
White Bear Lake, MN 55110

NATIONAL ASSOCIATIONS:

American Council For Elementary School Industrial Arts

American Industrial Arts Student Association

International Technology Education Association

1914 Association Drive
Reston, VA 22091

American Vocational Association

2020 North 14th
Arlington, VA 22201

The *Communication, Energy and Power Utilization, Production* and *Transportation* guides are available at a nominal cost from:

Minnesota Curriculum Services Center

3554 White Bear Avenue
White Bear Lake, MN 55110
612/770-3943
TOLL FREE WATS NUMBER
1-800-652-9024

he Minnesota Plan for Industrial Techology Education, A General
lanning Guide was developed by the following individuals

ruce Barnes
ak Grove Junior High School
loomington

onald Jandura, Superintendent of Schools
t. Cloud Public Schools
t. Cloud

onald Johnson
innesota Department of Education
t. Paul

ichard Pointer, Director of Vocational Occupations Education
uburban Hennepin AVTI
lymouth

om Ryerson
innesota Department of Education
t. Paul

nthony Schwaller, Chairman, Department of Industrial Studies
t. Cloud State University
t. Cloud,

an Smith, Director
arver-Scott cooperative Center
haska

lyron Twet
ohn Marshall High School
ochester

alph Vonasek
ermidji High School
ermidji

Dr. Ruth E. Randall
Commissioner of Education

Nan Skelton, Assistant Commissioner,
Partnership Division

J. Thomas Strom, Manager
Secondary Vocational Programs

Special Thanks To

Many people contributed their time and talents to provide direction for this
uide. To those listed and other who may have inadvertently been
issed great appreciation is extended.

eith Anderson
on Anderson
ilford Axdahl
avid Bangerter
avid Barkmeier
ruce Bernin
avid Bjorkquist
arry Burk
bAnne Collins
ichael Cooper
avid Crummy
avid Eckblad
ud Erickson
on Fisher
ohn Flatt
ern Fredeen
ohn Glas
oie Grandprey

Jeff Grimmer
Greg Hagen
Mark Haug
Joe Henry
Don Heuton
Orin Holton
Leon Houle
Chris Huber
Iver Johnson
Scott Johnson
William Kemp
Gerald Knapp
William LaCroix
Irving Larson
Len Litowitz
John Lobben
Carl Malm
Mike Mattson

Robert McEachern
Allen Meyer
Darvin Miller
Martin Motherway
Tom Nelson
Bud Néstel
Gerry Nystuen
Eugene Osland
James Pehler
Jim Peterson
Mary Phillips
Richard Pollei
Bruce Pylka
Donald Raether
Chuck Roepke
Harlan Scherer
John Schmitt

Robert Scorci
George Scott
David Sibley
Don Siems
Mike Simacek
Bill Smith
Dan Smith
Mike Smoczyk
Irving Strom
Wade Swenson
Don Thiesse
Rod Tooley
Richard Trumble
Matt Warren
Edsel Wicklund
Gary Wilkes
Karen Zuga

Minnesota Department of Education
550 Cedar Street
Saint Paul, Minnesota 55101